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ABSTRACT

WILLIAM BARRON. Determinants of Water-Related Personal Hygiene Practices: A Case Study of Children of Migrant Farmworkers in North Carolina. (Under the direction of JOHN BRISCOE)

This study builds on previous work which shows that (a) the quantities of water used for domestic purposes are affected by a variety of socio-economic and environmental conditions and (b) that the incidence of water-washed diseases is affected by the quantities of water used for personal hygiene.

The study uses a linear regression model to examine the determinants of reported personal hygiene practices of children in 87 farmworker families in eastern North Carolina . The results suggest that by ensuring that families have water piped into the house, handwashing is substantially increased and that by having access to heated water to showers, bathing of children, too, may be substantially increased. It is concluded that if hygiene practices of farmworkers are to be improved, enforcement of existing legislation will have to be improved and amendments to this legislation enacted.

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CHAPTER 1

INTRODUCTION

1.1 Nature of the Problem

The United Nations has declared the decade of the 1980's as the International Drinking Water Supply and Sanitation Decade. The ultimate goal of the Decade is to provide by 1990 the world's population with adequate domestic water supplies and excreta disposal facilities. At the beginning of the Decade it was estimated that 43% of the total population in developing countries (not including the People's Republic of China) had reasonable access to safe water and 25% of the total population had access to excreta disposal facilities (WHO, 1980). It was found that the urban areas had better access to water supplies, with 75% of the urban population in developing countries having access to water either through house connections or standpipes. In rural areas only 29% of the population had reasonable access to safe drinking water.

Since the majority of the world's population lives in rural areas and urban peripheries and it is in these areas that the greatest need exists for water supply development, the major task facing the Decade is the provision of safe

drinking water that is reasonably accessible to these communities. For rural areas, as well as for populations of urban peripheries, the provision of a high level of service is impractical. Financial and human resources are just not available to provide either house connections or yard-taps for the majority of the populations in rural sectors and urban peripheries (Feachem, 1975). Therefore, lower standards of service are necessary for the realization of Decade's goals to provide adequate domestic water supplies to all by 1990 (WHO, 1981).

1.2 Underlying Solution to the Problem

Resources for the provision of adequate water supplies to rural sectors and urban peripheries are limited, so they must be allocated in the most efficient and rational manner (Feachem, 1975). If resources were available to provide the level of service that developed countries have today (i.e. treated water at multiple taps and a flush toilet in every home) then there would be no need to determine the potential benefits of water supply improvements. However, resources are limited in developing countries, so the benefits resulting from combinations of improvements in water quality, water quantity, water supply availability and reliability must be evaluated.

Several benefits are anticipated from improvements of water supply. Improvements may alter the aesthetic quality of life; they may facilitate other development activity;

they may save time spent carrying water over long distances. A major benefit anticipated is improved health (Feachem, 1983). Therefore, planners need to know the health benefits which will emanate from different combinations and levels of improvements.

1.3 Approach of this Research

Reductions in the incidence of water-washed diseases have shown to occur as a result of the improved availability of water, the use of greater quantities of water and in improvements in water-related personal hygiene practices (handwashing). The research reported in this document is based on the premise that improvements in water-related personal hygiene practices (including handwashing and bathing) will cause a reduction in incidence of water-washed diseases. These hygienic practices are an integral part of a community and dependent on environmental and socio-economic conditions. Quantifying these behavioral practices and measuring the influence of external factors (e.g. level of water service, hygiene education and socio-economic factors) on these practices for each project area should provide useful information on the effect of different levels of water service and complementary hygiene education programs on health.

1.4 Specific Aims

The purpose of this research is to:

- a) develop an appropriate methodology for quantifying water-related personal hygiene practices (handwashing and bathing) and assess determinants of these practices;
- b) apply this methodology to a case study; and,
- c) discuss implications of the case study's principal findings.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

There are 2 types of studies which provide insight into this topic. Residential water demand studies have investigated the determinants of total and disaggregated water consumption. Epidemiological studies have examined the effect of changes in the availability of water, the quantity of water used, and water-related personal hygiene practices on water-washed disease incidence.

2.2 Residential Water Demand Studies

Adequate planning and management of water supply systems is dependent on predicting the quantity of water to be used in the future by a community. The demand for water is categorized into defined sectors of water use such as residential water use, commercial and institutional water use, and industrial water use. Demand models have been developed for each sector based on an understanding of the determinants of water consumption for that sector (Camp, 1978).

Current research on residential water demand is mostly limited to empirical studies in industrialized countries with few empirical studies having been performed in developing countries. Traditionally, residential water demand models are developed for the total quantity of water used for residential purposes. However, investigators have disaggregated total demand into indoor water demand (water used for personal and household hygiene, toilet flushing, drinking and cooking) and external water demand (water used for lawn and garden irrigation and animal needs) to examine the effect of water pricing and household income on water consumption for these different uses.

2.1.1 Total Residential Water Demand

In Industrialized Countries

The literature shows that a number of factors have an effect on the total quantity of water used for residential purposes in industrialized countries. These are: the price charged for water; household income; household size and composition; education, occupation and age of the head of the household; culture; seasonality; and, low water pressure and metering (Dunn and Larson, 1963; Howe and Linaweaver, 1967; Darr et al., 1975; Grima, 1972; Hogarty and MacKay, 1975; Danielson, 1979; Camp, 1978; Primeaux and Hollman, 1972).

Two factors, price and income, have been investigated closely in residential water demand studies in urban areas. Studies have determined price and income elasticities while controlling for other factors that explain variation in water demand. Magnitudes of these elasticities vary, with a typical price elasticity of -0.4 and income elasticity of 0.8 (Danielson, 1979). Residential water demand in the U.S. thus appears to be relatively inelastic with respect to price and relatively elastic with respect to income. Typically, these studies examine the adjustment of demand to a price change over a short period of time and for middle- and upper income consumers. It is expected that the long run change in residential water demand is probably larger and that low-income consumers would reduce consumption in response to a price increase more than wealthier consumers (Golladay and Katsu, 1981).

In Developing Countries

A review of the empirical work done in developing countries concerning total residential water consumption shows that variation in water consumption is influenced by: culture; cost of obtaining water (as measured by energy or cash expenditure); income of the household; level of water service; household size and composition; size of container used to carry water, and water-using equipment within the home (White et al., 1972; Lauria, 1981; Teller, 1963; Meroz, 1968; Lee, 1969; Hubbell, 1977; Katzman, 1977; Feachem et al., 1978; and, Msukwa, 1982).

Two studies in developing countries by Meroz (1968) and Katzman (1975) have shown that price and income elasticities are relatively low (-0.1 to -0.4 for price elasticity and 0.2 to 0.4 for income elasticity) for urban consumers. Hubbell (1977) investigated an urban area of Nairobi and found that the price and income elasticities for residents to be $-.48$ (moderately responsive to price changes) and $.36$ (relatively inelastic) respectively. The elasticities calculated for price and income were based on pooled cross-sectional data and are thus a mixture of short-run and long-run measures of elasticity. Therefore, these elasticities should be seen as an average measure and suggest that in the long-run price has an impact on water demand. Research has been restricted to settings with metered supplies and thus has focused on middle- and upper-income areas.

Sensitivity of the consumer to rate changes occurs because the consumer has limited income and limited assets. Howe and Linaweaver (1967) stated:

To buy more of one commodity then something of utility (possible savings) must be forgone, and this tradeoff will be greater the higher the price of the commodity and the greater importance to his welfare the lower the income. The effects of a price change on quantity demanded by a consumer can be broken down into two commodities: an income effect and a substitution effect.

The income effect will be greater for households where the amount spent on a commodity constitutes a larger proportion of the households income. Disposable income can

be seen as broken down into two parts, that income which is pre-allocated for expenditures such as housing, and that income which is spent at the discretion of the consumer. Hogarty and MacKay (1975) explain that water expenditure may be a significant item in the budget of a household in the short-run. These investigators argue that water expenditure should be compared to discretionary income and not disposable income. Discretionary income may constitute no more than 10-20 percent of disposable income. Therefore, if water rates are significantly increased, water expenditure will be significant in relation to discretionary income and the short-run income effect may be important in explaining changes in the demand for water.

In households where the expenditure for water is a large proportion of discretionary income, as may be the case in low-income households in developing countries, it is expected that there will be a greater change in the demand for water from a price change. In industrialized countries the income effect is considered negligible by some investigators (Howe and Linaweaver, 1967) because water expenditure is insignificant relative to a household's discretionary income.

The substitution effect is the other phenomena used to explain the demand elasticity for water. It may be difficult to understand what could substitute for water as a commodity. Consider the time frame given the consumer to respond to changes in water rates. In households of industrialized

countries where water consumption is closely linked with the possession of water-using appliances, we would expect over the short-run that water consumption would not be influenced by price changes; the consumer would not substitute more efficient appliances for existing appliances that consume less water. Over the long-run these changes are more likely to cause changes in water consumption (Howe and Linaweaver, 1967). However, for short periods of time, say a few months, the substitution effect can still be significant (Hogarty and MacKay, 1975). Consider for example the use of washing machines to clean clothes. If water rates are high, then the setting on the washing machine may be set at a lower quantity of water use per load rather than keep the setting at a high level no matter what quantity of clothes are being washed. Another example of short-run responses to rate changes, household members may shower less and children may be bathed together rather than separately.

As mentioned by Golladay and Katsu (1981) investigations of consumer behavior for low-income households and how they would respond to a price increase has not been examined. It is expected that low-income consumers would reduce consumption in response to a price increase more than wealthier consumers. This would result from the increase in price representing a larger proportion of income in low-income consumers than wealthier consumers.

The monetary amount spent for water doesn't represent completely the cost of obtaining water to consumers in peri-urban and rural areas. The distance which water has to be carried also represents a cost to the consumer. White et al. (1972), Feachem et al. (1978) and Msukwa (1982) have shown that for short-to-moderate distance, water demand is inelastic with respect to distance, but that when distances exceed about 1 kilometre the "distance elasticity" becomes negative.

Work by White et al. (1972), Frankel and Shouvana-virakul (1973) and Lee (1969) show water consumption increasing sharply once the level of service is upgraded from taps or sources outside the home to private connections.

The literature reveals the following with regard to the effect of socio-economic factors. As household size increases per capita use of water in unpiped and piped households decreases (White et al., 1972 and Teller, 1963). White et al. show education of the mother as not having an impact on the per capita use of water, and Teller (1963) was unable to correlate educational level of the mother and total water consumption. Ethnic difference was a strong determinant of quantity of water consumed in Bolivia by Teller (1963).

2.1.2 Disaggregated Residential Water Demand In Industrialized Countries

Methodological approaches to disaggregating residential water demand in industrialized countries have been patterned after a study by Howe and Linaweaver (1967). These investigators divided residential water demand into two components, domestic demand (indoor uses of water such as bathing, clothes washing, toilet flushing and dishwashing) and external demand (outdoor uses such as sprinkling and car washing). The use of just two components was a result of data collection limitations (e.g. the use of a separate metering device for each use). The external demand was estimated by subtracting winter demand from total summer residential demand, assuming domestic demand did not change from winter to summer.

For purposes of assessing quantities used for hygiene, the limitations of these previous residential water demand studies are that water use has been disaggregated into just two components, domestic water use and external water use. There is no understanding of the effect of determinants on water demand for the different domestic uses of water such as handwashing, bathing, clothes washing, dishwashing and toilet flushing.

Investigators have examined the relationship between water pricing and water use for the purpose of improving projections of water consumption and revenue potential. A review of the literature reveals differing results in

regard to the elasticity for total residential water use with respect to price (Camp, 1978 and Danielson, 1979 give good summaries of elasticity measurements for selected studies). Some investigators have illustrated that the price elasticity of water used inside the home (domestic demand) is notably less than that used for purposes outside the home (Howe and Linaweaver, 1967; Hanke, 1970; Danielson, 1979). Other investigations demonstrate that external demand is elastic with respect to price, and conclude that domestic demand is substantially more price elastic than previously measured (Hogarty and MacKay, 1975).

In summary, investigations of disaggregated residential water demand have resulted in the following conclusions:

- 1) water demand is substantially curtailed for external uses of water and even for domestic uses of water if water rates increase significantly,

- 2) in the short-run, the smaller a consumers discretionary income compared to disposable income then the greater will be the income effect of a price change on these uses of water, and

- 3) reductions in water demand for domestic and external uses of water will be greater the longer the time period which the consumer has to adjust to the price change. The magnitude of these changes is dependent on perceived substitutes for water usage.

Hogarty and MacKay (1975) have introduced the household production approach to consumer behavior as a possible conceptual framework for understanding residential water consumption. The household is conceptually understood as combining inputs such as, water, water-using appliances and facilities, household resources and time in producing

commodities such as personal cleanliness and household cleanliness. Reductions in domestic water demand from price increases are a result of water being substituted by time in order to more efficiently perform water-using activities.

In Developing Countries

Only one study has examined the elasticity of demand for water for different uses with respect to distance. In Mozambique Cairncross and Cliff (1983) showed that as the distance to the water source increased the quantities of water used for washing and bathing decreased, while the demand for other uses (drinking and cooking) was less elastic.

2.3 Epidemiological Studies

In the 1960's David Bradley proposed a scheme for classifying water-related diseases (Bradley and Emurwon, 1968). This classification scheme focused not on the traditional medical profession's grouping of diseases, according to the biology of the pathogens, but used a rationale based on the manner which water-related diseases are transmitted. The classification has four main categories:

- i) waterborne diseases - infectious diseases spread through water supplies;
- ii) water-washed diseases - diseases due to insufficient water for personal hygiene;
- iii) water-based diseases - diseases spread through aquatic invertebrate; and,
- iv) water-related insect vectors - diseases spread by insects living near water.

Since, as is typically the case, fecal-oral diseases are transmitted by non-water-borne fecal-oral routes, it is the water-washed diseases that constitute a large proportion of the cases of diarrheal diseases and are generally more important than the classic water-borne diseases (Feachem et al., 1983). Investigations involving the epidemiology of this important category of water-related diseases are reviewed.

2.3.1 Availability of Water

Improvements in the availability of water in communities have been shown to be significant in lowering the incidence of water-washed diseases. Through the provision

of piped water, levels of diarrhea incidence are reduced, as is shown by a study in Costa Rica (Moore et al., 1965) and by a study in Venezuela (Wolff and Zijl, 1969). In East Africa White et al. (1972) found that 19% of the households without piped water had a case of diarrhea in the week proceeding a survey, with only 3.1% of households with water connections suffering from diarrhea.

Early studies in the United States have looked at the effect of availability of water as the most effective environmental intervention for reducing diarrheal disease. In California during the 1950's a survey was implemented to determine the cause of the high incidence of shigellosis in migrant farmworker labor camps. The investigation concluded that an important mode of transmission of shigellosis was from person-to-person contact and that water availability and use had a considerable bearing on the prevalence of this disease (Watt et al., 1953). Other studies performed elsewhere in the United States indicated that infection rates were found to be high amongst groups where water was less available for hygienic use (Stewart et al., 1955). Further studies were undertaken in California to more clearly define the relationship between shigella infection and the availability of water for personal hygiene, such as laundry cleaning, bathing and handwashing facilities (Hollister et al., 1955). These suggest that significant reductions in a particular disease entity (shigellosis) can be achieved by providing an

adequate amount of water for personal hygiene.

2.3.2 Quantity of Water Used

Investigators have also looked at the effect of total domestic water use and its relationship to disease reduction. In a town in Sudan it was shown that there was decrease in the number of days illness per person with an increased daily water use per person (Bannaga and Pickford, 1978). Another cross-sectional study, in Haiti, focused on measuring water-washed disease incidence resulting from acute water shortages (Thacker et al., 1980). By identifying two populations with identical characteristics except for the levels of water provided, a correlation was made between disease incidence and quantity of water used in these two populations. The study suggested that a major determinant of illness was a reduction in water quantity made available from the water shortage.

An investigation of child health and diarrheal disease in relation to supply and use of water in African communities has shown that personal hygiene and quantity of water as powerful predictors of diarrheal disease (Freij et al., 1978).

There are fewer longitudinal studies investigating this relationship but one has shown a relationship between overall water use and diarrheal disease incidence (Rahman, 1977).

Observations in refugee camp situations reveal that specific diseases occur if adequate quantities of water are

not supplied (Cuny, 1983). The following scenario observed by Cuny illustrates this point as well as indicating that water-washed diseases (skin and diarrheal) are associated with the lack of sufficient water for hygienic purposes,

Fifteen to twenty liters of water per day (lpd) are considered the minimum for refugees in a camp. With various reductions in this quantity, certain routines or activities will not be possible. With the first reduction, (to 12 lpd's) clothes will not be washed. With the next reduction (9 lpd's), bathing will be greatly reduced. With the next reduction (6 lpd's), cooking utensils will not be properly cleaned. Next, food cannot be adequately prepared, contributing to malnutrition. Next, water will be inadequate to support strenuous activities, and at the lowest minimal level water will be insufficient to provide normal drinking requirements. With the first level of reduction, skin disease (scabies) and fungus will become a problem. At the point where the washing of cooking utensils is reduced, diarrheal diseases will become a problem.

Attempts have been made to incorporate information on the relationship between the quantity of water used and health into water supply planning. So far attention has concentrated on defining "threshold values" at the point which further increases in the quantity of water used have little impact on health. As noted by Briscoe (1984) those that have estimated "threshold values" have arrived at different estimates, from 15 lcd (Cuny, 1983), through 20-30 lcd (Hughes, 1983) to 50 lcd (McJunkin, 1983) and 60 lcd (Bannaga, 1978). It is expected that the above inconsistency in estimates of "threshold values" results from communities behaving differently with regard to the consumption of water for hygienic purposes. If two

communities were supplied similar quantities of water then the amount of water that households in one community use for hygienic purposes could be quite different than in the other community. As Briscoe (1984) explains. "the present method, in which large-scale epidemiological studies are used to identify regional or global 'target' (threshold) values appears to be impractical and theoretically unsound."

2.3.3 Water-Related Personal Hygiene Practices

Epidemiological investigations on the effect of water-related personal hygiene practices (handwashing and bathing) are few but conclusive. Studies examining this relationship directly are of two types: those which relate handwashing practices to changes in disease transmission; and, those which examine the occurrence and survival of enteric pathogens on hands.

An epidemiological study into the risk factors of trachoma in Mexico indicates that for those children who washed their hands less often, the incidence of trachoma was greater (Taylor et al., 1984). It was also shown that increased frequency of water use for hygienic practices was associated with an decreased incidence of diarrhea in the Philippines (Magnani et al., 1984). Recent intervention studies by Black et al. (1981) in a day care setting in the U.S., by Khan (1982) in a community setting in Bangladesh and, in a community setting in Guatemala (Feachem, 1984)

show that changes in behavioral practices of handwashing are important in stopping the transmission of diarrheal diseases, with there being reductions in diarrheal disease incidence of 14% to 48%.

Feachem (1984) has reviewed those studies that looked at the survival of enteric pathogens on hands of hospital staff and the attendants of sick children in industrialized and developing country situations. These studies reveal that handwashing with water and unmedicated soap removes 90% to 100% of bacteria with lesser proportions being removed while washing without soap. The effectiveness of handwashing was influenced more by the thoroughness of handwashing than by the types of soap or water used.

CHAPTER 3

RESEARCH DESIGN AND METHODS

3.1 Conceptual Framework

Traditionally water supply design procedures in developing countries have followed those used in industrialized countries, where the capacity of the system and the price to be charged are independent decisions with health considerations not entering into the decision-making process. As shown by Bradley (1976), the reality of the situation in developing countries is such that adoption of the design procedures used in industrialized countries is inappropriate. The level of water service and capacity of the system in developing countries becomes a critical factor to be considered by the designer. The distance from the water source to the home and the cost of the system (which determines the price charged for the water) affect the quantity of water used by the consumer (and thus the capacity of the system). In addition, water consumption levels are within a range where changes in the quantity of water used by the domestic consumer have an effect on the incidence of water-washed diseases.

A new conceptual framework has been developed by Briscoe (1984) for refining procedures in water system design in developing countries. This framework builds on the underlying hypothesis introduced by Bradley's scheme, viz. that the incidence of water-washed diseases is associated with the quantities of water used for personal hygiene (including handwashing and bathing). It is believed that measurements of the quantity of water used for personal hygiene should be made and the effect of distance, price charged for water and other determinants assessed. Since the quantity of water used for personal hygiene is monotonically related to the incidence of water-washed disease, the effect of investments in water supply improvements on incidence of water-washed diseases could be evaluated.

Decisions should be made on the decision rule that investments are targeted "to those communities where the marginal benefit [marginal change in quantity of water used for personal hygiene] of the investment is the greatest." Briscoe (1984).

This research will adopt the new conceptual approach presented by Briscoe with the specific aim of presenting a methodology for measuring the quantity of water used for personal hygiene (handwashing and bathing) and assessing the determinants of these quantities. In addition, since water-related personal hygiene practices (frequency of handwashing) have been shown to be a reasonable surrogate

of water-washed disease incidence, frequencies of hand-washing and bathing will be measured and determinants assessed.

3.2 Variables

3.2.1 Definition of Outcome Variables

Outcome variables are defined followingly:

- 1) Frequency of Handwashing- as the number of times that a child washes his/her hands or has his/her hands washed by someone else per day using water;
- 2) Frequency of Bathing- as the number of times that a child bathes or is bathed (in either a washtub or a shower) by someone else per week using water;
- 3) Quantity of Water Used for Handwashing- as the liters of water that a child uses per day for hand-washing;
- 4) Quantity of Water Used for Bathing- as the liters of water that a child uses per week for bathing.

3.2.2 Definition of Independent Variables

From the literature review of previous residential water demand studies in industrialized and developing countries (Section 2.2) independent variables can be categorized into two groups, socio-economic and environmental. The following independent variables are hypothesized as affecting water-related personal hygiene practices of infants and children:

SOCIO-ECONOMIC VARIABLES

- 1) Culture - defined by the ethnic group of the child's mother or guardian;
- 2) Maternal Education - defined by the number of years schooling of the child's mother or guardian;
- 3) Maternal Work Status - defined by whether the mother or guardian works;
- 4) Help with Childcare - defined by whether the mother or guardian receives assistance with taking care of the child, assistance from someone considered outside the family;
- 5) Household Size - defined by the number of people which are considered to be the family unit and living in the same dwelling; and,
- 6) Household Income - defined by the total amount of income that the family receives per year.

ENVIRONMENTAL VARIABLES

- 1) Cost of Obtaining Water - defined by the price charged for per liter of water and energy expenditure of collecting water;
- 2) Water Availability - defined by level of water service provided the family (e.g. public fountains, yardtaps, house connections or multiple-taps and, the availability of washing facilities at these sources of water);

- 3) Hygiene Education - defined by whether the mother and/or family has received exposure to education stressing the importance of handwashing and bathing;
- 4) Size of the Container Used to Carry Water - defined by the volume of water in liters that containers hold for carrying water from the source to the home.

3.3 Case Study

3.3.1 Study Population

On the East Coast of the United States, North Carolina continues to be the largest receiving state for migrant farmworkers. Typically about 50,000 migrant farmworkers make their way north from the southern states and join the approximately 140,000 "seasonal" farmworkers that during the months of May through November harvest cucumbers, peppers, sweet potatoes, other vegetable and fruit crops and tobacco.

Estimates by the State Employment Security Commission (David Craig, personal communication) shows that for the Tri-County Region of North Carolina (Johnston, Sampson and Harnett Counties) approximately 10,000 migrant farmworkers worked during the 1983 peak harvest period. Sampson and Johnston Counties receive the largest numbers of migrants in the state. The ethnic breakdown for these migrant farmworkers is the following: 52% Black American, 19% Haitian, 27% hispanic (Mexican-American, Mexican,

Cuban, Puerto Rican, Central American); with 2% white and Jamaican migrant farmworkers (Tri-County Community Health Center estimates). Most Black Americans travel to North Carolina in crews as single males with those Black American families traveling as a unit. Hispanics and Haitians travel in family groups with Haitian families associating with crews more than Hispanics. Estimates of percentages of children that make up this population are almost non-existent. However, the approximate breakdown as observed by those responsible for day-care services in Sampson County is the following: 65% Hispanic, 5% Haitian and 30% Black American (Faye Getty, personal communication).

The Tri-County area is located in the East Central section of North Carolina. Centrally located in this area is the Tri-County Community Health Center near Newton Grove which covers a 35 mile radius in these three counties. This health center provides service to migrant and seasonal farmworkers that work in the area. It is those farmworker families attending the Tri-County Community Health Center with children under 10 years old that were chosen as the study population.

Migrant farmworkers and their families live in the approximately 300 migrant camps in the Tri-County area. The crisis in housing at migrant camps in the United States has been recognized as a severe one according to the National Farmworker Housing Study (Inter-America Research Associates, Inc. et al., 1980). This study found that

migrant camps in North Carolina ranked among the lowest in terms of almost every variable which was considered. It was found that of the camps surveyed in North Carolina; 60% of migrant camp buildings exposed migrants to the outside elements; only 32% of migrant camp buildings were heated; buildings were structurally unsound and the conditions of camp drainage and garbage facilities the worst in comparison to camps in other states; camps were the most overcrowded, the most isolated from stores and public facilities and had the fewest sanitary facilities per occupant; 21% of buildings had no indoor plumbing.

Seasonal farmworkers and rural North Carolinians, as well, are living in conditions which are considered deplorable by national standards. In North Carolina at the end of the 1970's over 23% of rural housing had inadequate water supply and excreta disposal facilities, with over 200,000 homes not having indoor plumbing (National Demonstration Water Project, 1978).

This "great mass of excluded Americans" have some of the worst health conditions in the United States. The life expectancy for migrant farmworkers in the United States is 49 years (Chaze, 1982) while that of the general population is 75 years (World Bank, 1985). Mortality rates among migrant farmworkers is greater than that of the general U.S. populations with the mortality rate among farmworker infants and young children is about two and a half times that of the national average.

The percentage of parasites found in feces of migrant farmworkers has been identified at 30% to 50% by surveys in Massachusetts (Ortiz, 1980), in Maryland (Maryland Advisory Committee, 1983), in Illinois (Tulsky and Lichter, 1977) and in North Carolina (Edwards, 1984 and Elkins, 1977). A recent study by Edwards (1984) in North Carolina has shown that the prevalence of parasitism among children and mothers in migrant farmworker communities (communities in the Tri-County area being part of this study) is 43% and 20%, respectively. These high levels of pathogens including diarrheal pathogens (e.g. *Giardia lamblia*) have contributed to the poor health state of migrant farmworkers and their children in North Carolina.

3.3.2 Survey Instrument

A standardized questionnaire was used to collect information on the independent variables and dependent variables defined in Section 3.2. A copy of the questions that were asked is included in the appendix. The questionnaire was developed after having made several visits to migrant camps and having discussed water-related personal hygiene practices with migrants of all three ethnic groups. Much time was spent discussing with the Haitian Creole and Spanish translators what was intended to be asked through the questions.

3.3.3 Data Collection and Handling

Data Collection took place over a three month period during the summer of 1984. Families were identified by two methods. Records of a health outreach team of the Tri-County Community Health Center were used to identify migrant farmworker families with children under 10 years old. Willingness of the identified families to participate in the study was ascertained when a visit to the migrant camp was made. Families were also recruited when they came to the Health Center. In only two cases did families choose not to participate; these were both families that had been identified through outreach records. All interviews were performed by the author with the assistance of translators who either spoke Haitian Creole or Spanish. Both these translators had previously been migrant farmworkers and were living in and were familiar with the Tri-County area. Interviews were performed in the homes of the families, mostly during the evening after dinner but also during the afternoon. In all cases the mother of the family was the person interviewed.

CHAPTER 4

DATA ANALYSIS AND RESULTS

4.1 Analysis Methodology

4.1.1 Introduction

Factors thought to be associated with the frequency of handwashing, frequency of bathing and volumes of water used for handwashing and bathing are examined. First, descriptive statistics for the dependent variables are presented. Second, bivariate analyses are utilized to test the effect of each of the factors on the dependent variables without controlling for confounders. Third, multiple regression models are analyzed in which all of the determinants are considered simultaneously. Hypotheses are tested by estimating the coefficients of Ordinary Least Squares multiple regression models.

4.1.2 Definition of Dependent Variables

In this study, mothers in 87 households were interviewed concerning the handwashing and bathing of a total of 192 children under 10 years of age. A preliminary inspection of the interview data show that:

- (i) the handwashing and bathing patterns were quite different for children under and children over 2 years of age; and

- (ii) where there was more than one child in an age group (i.e. 0-2 or 3-10 years) in a household, the mother's responses were identical for each child in this age group.

Accordingly, it was decided that the number of observations would be determined as follows:

- (i) if the family had one or more children <2 years of age, there would be one observation in the <2 age group; and
- (ii) if the family had one or more children between 2 and 10 years of age, then there would be one observation for this age group.

Using the above rationale there were a total of 125 observations to be used in the subsequent analyses of frequency of handwashing and bathing of children.

Difficulties were encountered in gathering water consumption information on children who were using water directly from taps for handwashing and bathing. Therefore, only a proportion of these 125 observations were used in the analyses of the effects of different factors on the quantities of water used for handwashing and bathing. As a result, the sample of children used in the analysis of the quantity of water used for handwashing was limited to those children who did not wash their hands directly at taps, while the sample of children used in the analysis of the quantity of water used for bathing was limited to those children who did not use showers for bathing. Table 4.1 groups the full population of observations according to the different hand-washing and bathing categories.

From this table it can be seen that:

- (1) where all observations are used for the analyses of the dependent variables, "frequency of handwashing" and "frequency of bathing", there are a total of 125 observations;
- (2) for analyses of the dependent variable, "quantity of water used for handwashing", the analysis is restricted to those who do not use water taps for handwashing, and there are a total of 76 observations;
- (3) for analyses of the dependent variable, "quantity of water used for bathing", the analysis is restricted to those who do not use showers for bathing, and there are 95 observations.

Table 4.1 -- Reported hygiene practices for a sample population of children of migrant farmworkers in North Carolina, 1984

	Those who use showers for bathing	Those who use washtubs for bathing	Those who do not bath at all	Total
Those who use water taps for handwashing	22	27	0	49
Those who use washbasins for handwashing	2	30	0	32
Those who do not wash hands at all	6	37	1	44
TOTAL	30	94	1	125

It is important to note that the different samples do not represent obviously different populations. As is shown in Table 4.2 below, the composition of selected characteristics of families in the three samples is roughly similar.

Table 4.2-- Selected characteristics of migrant farmworker families in the three samples used

	Ethnic Group			Maternal Education		Family Size	
	Black	Hispanic	Haitian	0-6	>6	2-5	>5
1.Full Sample (N=125)	26%	54%	20%	51%	49%	66%	34%
2.Those who do not use taps for handwashing (N=76)	18%	57%	25%	61%	39%	66%	34%
3.Those who do not use showers for bathing (N=95)	26%	54%	20%	49%	51%	68%	32%

4.2 Descriptive Statistics

Table 4.3 below shows that the standard deviation for the dependent variable "quantity of water used for handwashing" is twice the mean value. This large variation may indicate that information extracted for this dependent variable is questionable. However, the coefficients of variation (standard deviation/mean) for the other dependent variables are reasonable.

Table 4.3-- Means and Standard Deviations for Dependent Variables

Dependent Variables	Sample Size	Mean	Standard Deviation
Frequency of Handwashing (# times/child/day)	125	1.7	1.3
Quantity used for Handwashing (liters/child/day)	76	9.6	19.1
Frequency of Bathing (# times/child/week)	125	12.3	7.5
Quantity used for Bathing (liters/child/week)	95	496.9	446.3

Table 4.4 shows that the mean and standard deviation of frequency of handwashing for the different ethnic groups are quite similar. However, the means and standard deviations of frequency of bathing, quantity used for handwashing and quantity used for bathing are noticeably different for the different ethnic groups.

Table 4.4-- Means and Standard Deviations for Dependent Variables (Sorted by Ethnic Group)

Dependent Variables	Sample Size	Mean	Standard Deviation
Frequency of Handwashing (# times/child/day)			
Black American	33	2.0	1.4
Haitian	24	2.2	1.2
Hispanic	68	1.4	1.6
Quantity used for Handwashing (liters/child/day)			
Black American	14	8.3	11.0
Haitian	19	16.5	16.0
Hispanic	43	6.9	21.9
Frequency of Bathing (# times/child/week)			
Black American	33	9.6	4.4
Haitian	24	18.1	3.9
Hispanic	68	11.7	8.6
Quantity used for Bathing (liters/child/week)			
Black American	25	441.8	434.3
Haitian	19	430.1	239.4
Hispanic	51	548.9	507.3

Examining the frequency distributions (Figures 4.1 - 4.4), the distribution for frequency of bathing appears to be approximately normally distributed (Figure 4.2). In contrast, the frequency distribution of observations for quantity used for handwashing (Figure 4.3) and quantity used for bathing (Figure 4.4) are skewed towards the left.

The frequency distribution of observations for frequency of handwashing (Figure 4.1) is bimodal, and shows that on the most part, over 30% of the sampled population, mothers were responding that children were not having their hands washed or were not washing their hands themselves. For the sampled population that did not use water taps for handwashing (Figure 4.3), responses are greatly distributed to the left with over 55% of the sampled population responding that a zero quantity of water was used for handwashing.

FREQUENCY DISTRIBUTIONS FOR
DEPENDENT VARIABLES

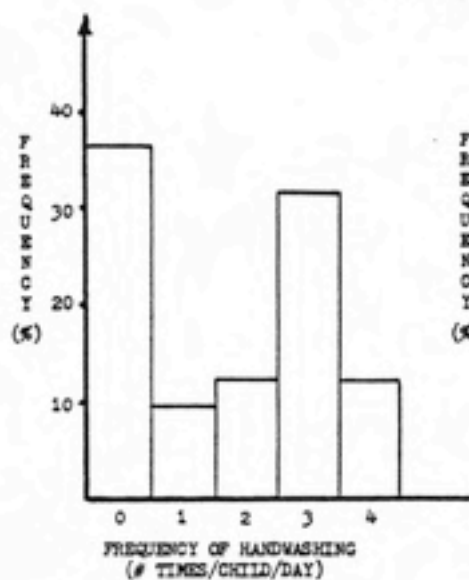


FIGURE 4.1

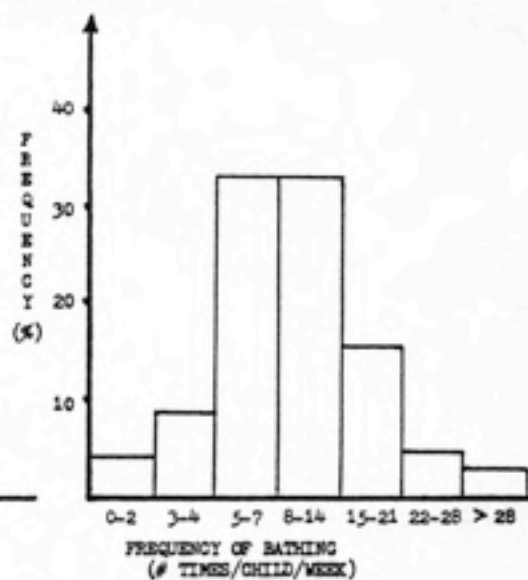


FIGURE 4.2

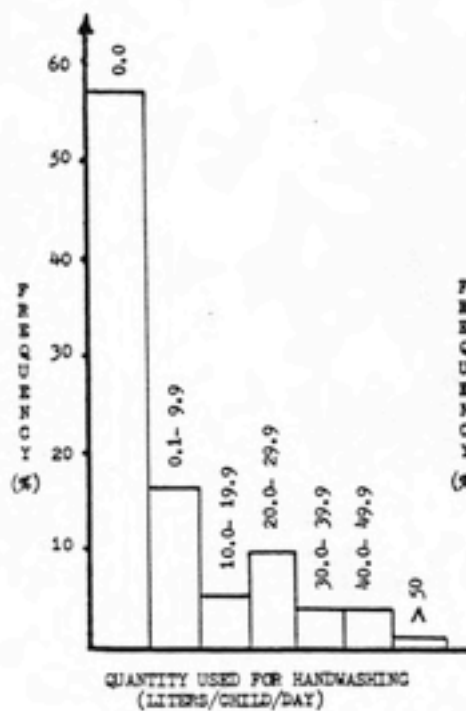


FIGURE 4.3

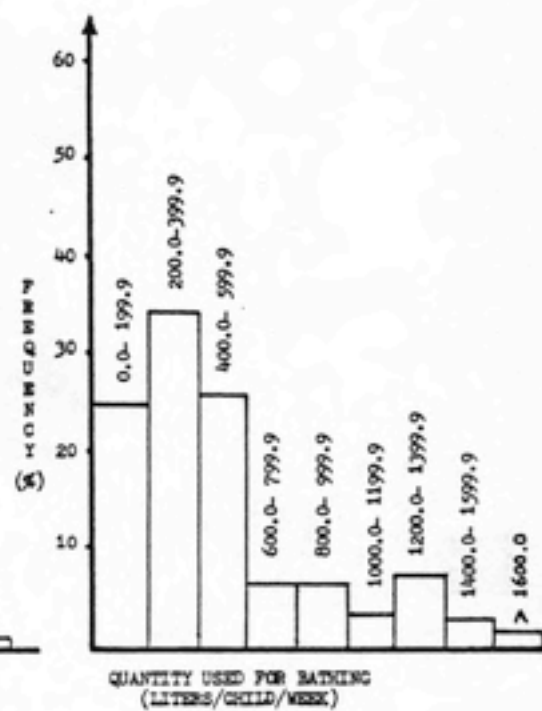


FIGURE 4.4

4.3 Bivariate Analyses

4.3.1 Methodology

As a preliminary exploration of the effect of study factors on the dependent variables, bivariate comparisons were run for each factor without controlling for other, potentially confounding, variables. From this, the relationship between study factors and the dependent variables can be explored to determine the direction of the association, the extent of the association, and the strength of the relationship.

For each factor, two categories of observations were defined and a student's t test was utilized to test the hypothesis that the true means of categories defined for the dependent variables are equal ($p=0.05$). Statistics were computed based on the assumption, first, that the variances of the two groups are equal and, second, that the variances are unequal. To determine which t statistic is applicable, the hypothesis that the variances are equal was tested using two-tailed F-tests (SAS Institute, 1982).

4.3.2 Results of Bivariate Analyses

Observations of migrant farmworker children under 10 years old suggest that a number of factors are associated with the dependent variables.

Bivariate comparisons of groups with and without certain characteristics are presented on Tables 4.5 & 4.6.

The dependent variables examined are:

- frequency of handwashing and frequency of bathing for all children (N=125);
- quantity of water used for handwashing for children who do not use taps for handwashing (N=76);
- quantity of water used for bathing for children who do not use showers for bathing (N=95).

THE EFFECT OF SOCIO-ECONOMIC DETERMINANTS

Ethnicity

Handwashing

Haitian children's hands are washed slightly more frequently than those of Black Americans, with Hispanic children's hands being washed less frequently than those of Haitian and Black Americans. For the subpopulation that does not use taps for handwashing, the differences between ethnic groups for quantities of water used for handwashing is similar to those indicated above for frequency of handwashing. For handwashing Haitians use almost twice as much water for handwashing as the other ethnic groups, a difference which is highly statistically significant.

Bathing

Haitians bathe more frequently than either Hispanics or Black Americans, with Black Americans bathing the least. The quantities used for bathing by children is not significantly different for the different ethnic groups.

Age of Child

Handwashing

The frequency and quantity of water used for handwashing does not show any statistical difference between means for the different age groups of children.

Bathing

Children between the ages of 0-2 are bathed significantly more frequently than older children, with quantities of water used for bathing slightly greater among children between the ages of 3-10.

Table 4.5-- Means of dependent variables for bivariate comparisons of socio-economic determinants

INDEPENDENT VARIABLES	DEPENDENT VARIABLES			
	HANDWASHING		BATHING	
	Frequency (# times/ child/ day) (N=125)	Quantity used (liters/ child/ day) (N=76)	Frequency (# times/ child/ week) (N=125)	Quantity used (liters/ child/ week) (N=95)
SOCIO-ECONOMIC DETERMINANTS				
Ethnic Group				
Black American	2.0(33)	8.3(14)	9.6(33)	441.7(25)
Other	1.6(92) (1.2)	9.9(62) (0.4)	13.3(92) (3.3)*	516.7(70) (0.7)
Hispanic	1.4(68)	6.9(43)	11.6(68)	548.9(51)
Other	2.1(57) (2.5)*	13.0(33) (1.5)	13.2(57) (1.2)	436.7(44) (1.3)
Haitian	2.2(24)	16.5(19)	18.1(24)	430.1(19)
Other	1.6(101) (2.0)	7.3(57) (2.1)*	11.0(101) (6.5)*	513.7(76) (1.1)
Age Group				
0-2 years	1.7(70)	10.9(46)	13.6(70)	478.1(64)
3-10 years	1.8(55) (0.3)	7.6(30) (0.8)	10.7(55) (2.2)*	535.9(31) (0.5)
Maternal Education				
0-6 years	1.7(64)	9.6(46)	13.4(64)	529.6(47)
>6 years	1.8(61) (0.3)	9.5(30) (0.03)	11.2(61) (1.6)	465.1(48) (0.7)
Household Size				
2-5 persons	1.9(83)	13.2(50)	13.9(83)	490.6(65)
>6 persons	1.4(42) (1.7)	2.5(26) (3.2)*	9.2(42) (3.8)*	510.7(30) (0.2)
Maternal Work Status				
Yes	1.4(60)	6.4(41)	11.1(60)	513.0(49)
No	2.0(65) (2.2)*	13.3(35) (1.5)	13.5(65) (1.8)	479.9(46) (0.4)
Help with Childcare				
Yes	1.3(44)	3.7(26)	11.4(44)	592.2(31)
No	1.9(81) (2.2)*	12.6(50) (2.5)*	12.9(81) (1.0)	450.8(64) (1.2)

Note: The t statistics are reported in parentheses beneath the mean values.

* represents a 5% significance level.

The sample population size for the groups defined are indicated in parentheses to the right of mean values.

Maternal Education

Handwashing

The frequency and quantities of water used for handwashing is not affected by differing levels of education of the mother.

Bathing

The number of years schooling of the mother appears to slightly reduce the frequency and quantity of water used for bathing.

Household Size

Handwashing

Children in smaller households seem to have their hands washed much more frequently. Smaller households use statistically greater quantities of water for handwashing of their children.

Bathing

The effect of a smaller household is to increase the frequency of handwashing of children. However, a difference in household size has no effect on the quantities of water used for bathing of children.

Maternal Work Status

Handwashing

For children whose mothers do not work, the frequency of handwashing is substantially higher than for those whose mothers do work. For those who do not wash directly at taps, the quantity of water used for handwashing is substantially higher for children whose mothers do not work.

Bathing

For children whose mothers do not work, the frequency of bathing is slightly higher than for the children who do work. The quantities of water used to bathe a child appear to be similar irrespective of the mother's work status.

Help with Childcare

Handwashing

Outside assistance in childcare reduces the frequency of handwashing of children and drastically reduces the quantity of water used for handwashing.

Bathing

Neither the frequency of bathing nor the quantity of water used for bathing are affected by whether or not the mother has assistance with child care.

THE EFFECT OF ENVIRONMENTAL DETERMINANTS

Water Availability

The availability of water was categorized in three ways:

- 1) access to washing facilities (either inside the dwelling or outside at public facilities) vs. no access to facilities;
- 2) there is a house connection vs. no house connection;
- 3) whether the family lives in a house with multiple water taps vs. a house with no multiple taps.

Handwashing

By having access to adequate water facilities, either inside the family's dwelling or outside, frequency of handwashing is increased by a factor of two as compared to those who do not have access to facilities. With improvement of water service by supplying a house connection, there is no statistical difference in the mean values for the two groups compared. However, by supplying multiple taps in the family's dwelling, there is a significant increase in the frequency of handwashing.

Bathing

There is a substantial improvement (almost two times) of frequency of bathing with having access to adequate washing facilities. But, the improvement in availability to water by either having a house connection or multiple taps in the house has no apparent effect on frequency of

Table 4.6-- Means of dependent variables for bivariate comparisons of environmental determinants

INDEPENDENT VARIABLES	DEPENDENT VARIABLES			
	HANDWASHING		BATHING	
	Frequency (# times/ child/ day) (N=125)	Quantity used (liters/ child/ day) (N=76)	Frequency (# times/ child/ week) (N=125)	Quantity used (liters/ child/ week) (N=95)
ENVIRONMENTAL DETERMINANTS				
Water Availability				
Access to facilities				
Yes	1.9(103)	10.4(55)	13.5(103)	572.7(73)
No	1.1(22) (2.7)*	7.3(21) (0.9)	7.0(22) (4.5)*	245.7(22) (4.9)*
House Connections				
Yes	1.9(53)	4.0(22)	11.9(53)	581.0(41)
No	1.6(72) (1.4)	11.8(54) (2.0)*	12.7(72) (0.6)	433.1(54) (1.5)
Multiple Taps				
Yes	2.5(23)	13.3(4)	11.2(23)	540.1(16)
No	1.5(102) (3.2)*	9.4(72) (0.3)	12.6(72) (0.9)	488.2(79) (0.5)
Hot Water Heater				
Yes	1.9(92)	10.1(49)	14.0(92)	548.9(62)
No	1.3(33) (2.2)*	8.6(27) (0.4)	7.6(33) (5.3)*	400.3(33) (1.5)
Hygiene Education				
Yes	1.6(51)	11.9(35)	13.3(51)	531.2(45)
No	1.8(74) (0.7)	7.6(41) (1.0)	11.7(74) (1.1)	466.1(50) (0.7)
Size of Washtub				
0-30 liters	----	----	-----	282.2(24)
> 30 liters				584.2(69) (4.2)*

Notes: The t statistics are reported in parentheses beneath the mean values.

* represents a 5% significance level.

The sample population size for the groups defined are indicated in parentheses to the right of mean values.

bathing. Investigating the effect of water availability on water consumption for the use of bathing, there is a similar pattern. Those who have access to some facilities use almost twice as much water than those who do not have access. There is a significant increase in quantity used for bathing for those families that have house connections, with no increase in water consumption when multiple taps are provided.

Availability of Hot-Water Heaters

Handwashing

Provision of hot water heaters in dwellings has the effect of substantially increasing the frequency of handwashing, but has no effect on the quantity of water used for handwashing.

Bathing

Similarly, but to a greater degree, families who live in dwellings in which hot water heaters are available, the frequency of bathing is significantly greater than for families who live in dwellings which do not have access. It appears that the quantity of water used for bathing is greater among those households that have hot water heaters provided.

Hygiene Education

Handwashing

There is little effect of prior exposure to hygiene education on the frequency of handwashing, with the quantity of water used for handwashing appearing to be greater among those mothers that had hygiene education.

Bathing

It appears that exposure to hygiene education is associated with the bathing of children more frequently and larger quantities of water being used for bathing. These differences are not significantly significant.

Size of Washtub

The size of the containers used for bathing was strongly associated with the volume of water used for bathing.

4.4 Multivariate Regression Analyses

4.4.1 Methodology

An Ordinary Least-Squares approach was used for estimating the coefficients for the multi-variate regressions. The least-squares approach selects the parameters which minimize the sum of squares of the differences between the observed values of the dependent variable predicted by the model.

Some of the dependent variables (frequency of handwashing and frequency of bathing), are ordinal in nature. For the dependent variable, frequency of handwashing, the observed responses have a limited range from 0-4 and are clustered around values of 0 and 3. For the dependent variable, frequency of bathing, the observed responses are clustered around the values of 7, 14, 21 and 28. When observed responses are limited in range and/or clustered around values then these responses are characterized as "ordinal".

A linear model assumes that the data are distributed about some line and that the error term has zero mean and constant variance. These assumptions are generally violated when ordinal dependent variables are used (McKelvey and Zavoina, 1975). Where the dependent variable is ordinal, the linear model often implies a weak relation between independent and dependent variables. Despite this limitation, simple linear models will be used for this analysis, with the understanding that there are limitations

inherent in their use. Consequently, significant associations might not be showing up in the multiple regression analyses that might be revealed if more sophisticated analytic techniques, such as logit or probit techniques were used (Judge et al, 1980).

The regression models estimated will not include second-or-higher order independent terms. These more sophisticated models were thought to not be any more useful at this stage of study than simple first-order models, since the purpose of the analysis is to determine factors that are significant in explaining variation in the dependent variables and not for the estimation of equations for predictive purposes.

In this analysis, the most important statistics are the regression coefficients associated with independent variables. To test specific hypotheses about the effects of the independent variables, the sign and magnitude of regression coefficients are examined. The *t* statistics for each regression coefficient tests the hypothesis that these coefficients are truly different from zero.

4.4.2 Hypotheses to be tested

Based on the literature review and the preliminary results of the bivariate analyses (in Section 4.3.2), the following hypotheses were tested with multiple regression models.

The frequency of hand-washing and bathing of children, and the quantities of water used for these activities, will be affected by:

- ethnic group
- age of the child
- maternal education
- household size
- maternal work status
- help with childcare
- level of water service
- availability of heated water
- exposure to hygiene education
- container size used for bathing children.

4.4.3 Results of the Multiple Regression Analyses

The hypotheses are tested by estimating the coefficients of Ordinary Least Squares multiple regression models, results are presented on Table 4.7 below.

The F-value (indicating whether the proportion of the variation in the dependent variable that is explained by the independent variables is greater than would be expected by chance alone) and the correlation coefficient (R-squared) (which indicates the proportion of variance explained by the regression) are given on Table 4.7 for each regression. It is common in investigations of the determinants of health-related behavior and health outcomes (Schultz, 1984) for the R-squared value to be modest. By this standard the R-squared in this investigation (ranging between 18% and 37%) are surprisingly high. In addition, the F-value is high (significant at the 5% probability level) in three out of four regressions. Therefore, for these three regressions,

Table 4.7-- Effect of Independent Variables on Hygiene Practices of children of migrant farmworkers in North Carolina, 1984

INDEPENDENT VARIABLES	DEPENDENT VARIABLES			
	HANDWASHING		BATHING	
	Frequency	Quantity used	Frequency	Quantity used
	(# times/ child/ day) (N=125)	(liters/ child/ day) (N=76)	(# times/ child/ week) (N=125)	(liters/ child/ week) (N=95)
SOCIO-ECONOMIC DETERMINANTS				
Ethnic Group				
Black American (Yes=1; No=0)	-0.66 (1.09)	-15.56 (1.37)	-7.94 (2.84)**	-105 (0.57)
Hispanic (Yes=1; No=0)	-0.96 (2.18)**	-11.32 (1.45)	-6.27 (3.09)**	-139 (0.98)
Age Group				
0-2 yrs =1; 3-10 yrs = 0)	-0.21 (0.80)	-0.29 (0.06)	1.17 (0.96)	-19 (0.21)
Maternal Education				
(Continuous, in years)	0.06 (1.28)	1.33 (1.34)	0.08 (0.33)	-3 (0.21)
Household Size				
(Continuous)	0.04 (0.47)	0.47 (0.28)	-0.01 (0.02)	43 (1.59)*
Maternal Work Status				
(Yes=1; No=0)	-0.52 (1.82)*	-7.76 (1.56)*	-0.43 (0.32)	7 (0.08)
Help with Childcare				
(Yes=1; No=0)	-0.33 (1.01)	-0.47 (0.64)	0.93 (0.61)	50 (0.49)
ENVIRONMENTAL DETERMINANTS				
Water Availability				
a) Access to facilities (Yes=1; No=0)	0.58 (1.28)	4.44 (0.63)	2.48 (1.17)	325 (2.54)**
b) House Connection (Yes=1; No=0)	-0.31 (0.95)	-10.64 (1.85)*	-0.80 (0.52)	43 (0.40)
c) Multiple Taps (Yes=1; No=0)	1.13 (2.74)**	9.39 (0.81)	-1.07 (0.56)	-333 (2.43)**
Hot Water Heater				
(Yes=1; No=0)	-0.07 (0.17)	-2.25 (0.34)	5.21 (2.85)**	26 (0.22)
Hygiene Education				
(Yes=1; No=0)	-0.14 (0.50)	0.17 (0.03)	2.28 (1.83)*	55 (0.64)
Size of Washtub	--	--	--	2.4
(Continuous in liters)				(4.90)**
F-value	2.42**	1.11	4.65**	3.64**
R-squared	0.21	0.18	0.33	0.37

Note: The absolute value of t ratios is reported in parentheses beneath the regression coefficients.

* indicates a 10% significance level.

** indicates a 5% significance level.

the proportion of the variation in the dependent variable explained by the independent variables is greater than would be expected by chance. The multiple regression model for the dependent variable, "quantity of water used for handwashing", has a F-value that is not significant at the 5% level of significance. However, it should be reiterated that the importance of the analysis of this study is to determine factors that are significant in explaining the dependent variables and not for the estimation of equations for predictive capabilities.

THE EFFECT OF SOCIO-ECONOMIC DETERMINANTS

Ethnic Group

Children of Black American and Hispanic migrant farmworker households wash their hands less frequently and use less water for handwashing than children of Haitian households. The regression coefficients for Black Americans and Hispanics also indicates that children of these ethnic groups bathe substantially less frequently than children of Haitian households.

Maternal Education

The effect of mothers having more education is to increase the number of times that children's hands are washed and to cause larger quantities of water for handwashing to be used.

Household Size

The children of larger households use larger quantities of water for bathing.

Maternal Work Status

The effect of mothers working outside the home is to decrease the frequency of handwashing of children and to lead to smaller quantities of water being used for this purpose.

Help With Childcare

Where someone other than the mother takes care of the child, children's hands are washed less frequently.

THE EFFECT OF ENVIRONMENTAL DETERMINANTS

Water Availability

Investigating the effect of water availability on water-related hygiene practices is achieved through interpreting the regression coefficients for three dummy variables. These three dummy variables represent whether the household has access to (a) washing facilities, (b) a house connection, and (c) access to multiple taps. The regression coefficients for line a) represents the effect of an improvement of level of water service from having an outside tap only and no washing facilities to having an outside tap but having washing facilities (either outside or inside the home). The regression coefficients for line b) represents the effect of the next level of water service improvement (viz. provision of a house connection). The regression coefficients for line c) represents the effect of the final level of water service improvement (viz. multiple taps are provided in the house).

Handwashing

The effect of an improvement in access to washing facilities is to increase the frequency of handwashing. The next level of improvement, viz. having a house connection, has no effect on frequency of handwashing, however, the quantity of water used for handwashing apparently decreases. Finally, where multiple taps are provided the frequency of handwashing increases substantially.

Bathing

The provision of washing facilities for those that have none has the effect of increasing, significantly, the frequency of bathing and the quantity of water used for that purpose. By supplying a house connection, there is no effect on the frequency and quantity of water used for bathing. With the final level of improvement (viz. multiple taps), the quantity of water used for bathing appears to decrease substantially. However, if it had been possible to estimate the quantities of water used for bathing by those who shower then this effect may well have been reversed.

Availability of Heated Water

The availability of heated water increases significantly the frequency of bathing.

Exposure to Hygiene Education

Where mothers had prior exposure to hygiene education their children are bathed more frequently.

Size of Container Used for Bathing

Where the size of washtub used for bathing is larger the quantity of water used for bathing increases.

CHAPTER 5

CONCLUSIONS

The ultimate purpose of this analysis is to identify public policies which may improve the health of farmworker children. By identifying and implementing public policies that would improve water-related personal hygiene practices it is expected that the high incidence of water-washed diarrheal diseases found among children of North Carolina farmworkers would be reduced. This case study has identified two policy areas that may affect water-related personal hygiene practices of children under 10 in the study population. These are the provision of improved water supply and washing facilities and the provision of health education programs that stress the importance of hand-washing and bathing.

The specific policy implications are as follows:

- 1) For the Provision of Improved Water Supply and Washing Facilities:
 - i) the frequency of handwashing is expected to be maximized by the provision of multiple taps with adequate washing facilities in each house; and
 - ii) the frequency of bathing is expected to be maximized by the provision of heated water either at washing facilities in each house or at public washing facilities in the farmworker camp.

2) For the Provision of Health Education Programs that Stress the Importance of Handwashing and Bathing:

the frequency of bathing is expected to increase where hygienic education is conducted. These health education programs should focus on handwashing & bathing practices. The information would have to be tailored to the needs of each ethnic group. Specific attention should be made to design health education programs so that frequent handwashing is stressed.

Existing legislation on water service for all temporary farm labor camps holding ten or more people requires that the source of water be located less than 200 feet from each housing unit, and that warm water be made available at bathing facilities in each camp (North Carolina, 1980). A first requirement is that existing legislation be enforced, since the level of enforcement is extremely important in assuring that the housing conditions meet the existing standards (Clayton, 1981). This study also suggests that existing legislation should be revised to upgrade the level of water service to that which the average American enjoys, heated water at multiple taps inside the dwelling. These improvements should have the effect of improving the level of health of farmworker children.

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APPENDIX

FARMWORKER WATER USE SURVEY

1. Migrant Farmworker Family () or
Seasonal Farmworker Family()
2. Haitian Family(), Hispanic Family(),
Black American Family(), or other()
3. How many people of your family were living here in this
place during the last week?
4. What are the ages of all your children under 10 years
old that are living in this place?
5. Who took care of these children during the working
hours of the past week?
6. Who took care of these children during the non-working
hours of the past week?
7. Is there running water here inside this place that you
and your family live?

(If yes) Was water always available from these taps
and showers during the past week?

Is there hot running water available from
these taps and showers?

8. Is there running water available from taps and showers
at facilities outside this place that you and your
family are living?

(If yes) Was water available from these taps and
showers during the past week?

Is there hot running water available from
these taps and showers?

10. Did someone from your family have to carry water in
order to wash and bathe children during the past
week?

(If yes) Where was water last gotten for handwashing
and bathing of children under 10 years old?

How far was water carried?

11. (For each child under 10 years old)

What is the child's age?

Where and how did the child have their hands last washed?

Who washed their hands?

When was that?

When was the time before that?

How many times did each child have their hands washed or washed their hands yesterday?

Was soap used?

(If handwashing is done with washbasins rather than using running water from taps)

What washbasin was used for handwashing?

How full was this washbasin last filled for handwashing?(show me the level)

How was the washbasin prepared for handwashing (whether water was changed during the day and how many times changed during the day)?

Do adults use this washbasin for handwashing?

Is this washbasin owned by the family?

How many families share this washbasin with your family?

12. (For each child under 10 years old)

What is the age of the child?

Where and how did the child last bathe?

Who bathed them?

When was that?

When was the time before that?

How many times did the child bathe during the last week?

Was hot water used?

(If bathing is done with a washtub rather than showers)

What washtubs were used for bathing?

How full was the washtub last filled for bathing this child?(show me the level)

How was the the bath prepared?
(whether water was changed and how many times changed)

Was water used to rinse this child?

Is this washtub used by adults?

Is this washtub owned by your family?

How many families share this washtub with your family?

13. Has anyone ever talked with you (or anyone in your family) about the importance of handwashing and bathing of children? and about using soap?

(If yes) Where and who was this?

How often and where have you (or anyone in your family) gone to a health clinic in the past year?

14. How many years schooling do you have?

15. Do you work?

Where do you work and how often?